

### Claims

1. Water-soluble monometal-oxide colloids having particle sizes in the range of 0.5 - 5 nm, made from metals of the groups VIb, VIIb, VIII, Ib or IIb of the periodic table, which are stabilized by water-soluble additives.
2. Water-soluble bi- and multimetal-oxide colloids having particle sizes in the range of 0.5 - 5 nm, made from metals of the groups VIb, VIIb, VIII, Ib, IIb of the periodic table, which are stabilized by water-soluble additives.
3. Water-soluble bi- and multimetal-oxide colloids having particle sizes in the range of 0.5 - 5 nm, made from a metal of the main group and from one or more metals of the groups VIb, VIIb, VIII, Ib, IIb of the periodic table, which are stabilized by water-soluble additives.
4. Colloids according to claim 3, wherein the metal of the main group of the periodic table is tin.
5. Colloids according to claims 1 - 4, wherein amphiphilic betains, cationic, anionic and nonionic surfactants or water-soluble polymers are used as water-soluble additives.
6. A process for producing additive-stabilized, water-soluble, mono-, bi- and multi metallic metal-oxide colloids having particle sizes in the range of 0.5 - 5 nm, characterized in that metal salts or mixtures of two or more metal salts are hydrolyzed or condensed

or co-condensed, respectively, in basic aqueous solutions in the presence of a stabilizer in form of the additive.

7. The process according to claim 6, characterized in that salts of metals of the groups VIb, VIIb, VIII, Ib or IIb of the periodic table are hydrolyzed or condensed, respectively, in order to prepare water-soluble, monometallic metal-oxide colloids.
8. The process according to claim 6, characterized in that mixtures of two or more salts of metals of the groups VIb, VIIb, VIII, Ib and/or IIb of the periodic table are hydrolyzed or co-condensed, respectively, in order to prepare water-soluble, bi- or multi metallic metal-oxide colloids (mixed metal-oxide colloids).
9. The process according to claim 6, characterized in that mixtures of a salt of a metal of the groups VIb, VIIb, VIII, Ib or IIb and of a salt of a metal of a main group of the periodic table are hydrolyzed or co-condensed, respectively, in order to prepare water-soluble, bimetallic metal-oxide colloids.
10. The process according to claim 9, wherein the salt of a metal of a main group of the periodic table is  $\text{SnCl}_2$  or  $\text{SnCl}_4$ .
11. The process according to claims 6 - 10, wherein water-soluble amphiphilic betains, cationic, anionic or nonionic surfactants or water-soluble polymers are used as stabilizer in form of an additive.

09331566-054001

12. The process according to claims 6 - 11, wherein a carbonate, bicarbonate, a hydroxide, a phosphate or a hydrogen phosphate of an alkali metal or an alkaline earth metal is used as a base.
13. The process according to claim 12, wherein  $\text{Li}_2\text{CO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_2\text{CO}_3$ ,  $\text{Cs}_2\text{CO}_3$  or  $\text{MgCO}_3$  are used as a base.
14. The process according to claims 6 - 13, characterized in that the reaction temperature is between 20 and 100 °C, preferably, between 50 and 90 °C.
15. The process according to claims 6 and 8 to 14, characterized in that the mass ratio of the metals in the bi- or multi metallic metal-oxide colloids is controlled by the corresponding choice of the mass ratio of the metal salts.
16. The process for preparing water-soluble, nanostructured, mono-, bi- and multi metallic metal colloids having particle sizes of 0,5 nm to 5 nm, characterized in that the corresponding metal-oxide colloids can be produced according to the claims 6 to 15 and subsequently be reduced.
17. The process according to claim 16, wherein hydrogen, hypophosphite or formate are used as a reduction agent.
18. The process for fixation of the metal-oxide colloids prepared according to the claims 1 to 5, and of the metal-oxide colloids which are prepared therefrom according to the claims 16 to 17 on solid supports, characterized in that solid oxidic or non oxidic solid materials are treated with aqueous solutions of the colloids.

09831566-051001

~~19. The process for immobilization of the metal-oxide colloids which are prepared according to the claims 1 to 5, and of the metal-oxide colloids which are prepared therefrom according to the claims 16 to 17, characterized in that they are incorporated in sol-gel-materials.~~

20. The process according to claim 19, wherein sol-gel-materials are used, for which  $\text{Si}(\text{OCH}_3)_4$  or mixtures of  $\text{Si}(\text{OCH}_3)_4$  and  $\text{C}_n\text{H}_{2n+1}\text{Si}(\text{OCH}_3)_3$  ( $n = 1$  to  $4$ ) are used as gel precursors.

Add A2

09831566-051003